

dioxide and water). The difficulty, however, is imaginary, and the result is possible, because (a) the position of equilibrium in the reversible change  $\text{CO}_2 + 3\text{H}_2\text{O} \rightleftharpoons \text{HCHO} + 2\text{H}_2\text{O}_2$  is displaced towards the right by the addition of light energy, and (b) the process is continuous so long as the products on the right-hand side are removed, as in a living plant they are.

H. Euler ('Zeits. für physiol. Chemie,' 1909, vol. 59, p. 122) supports Ewart's criticisms, without, however, giving any particulars (*cf.* foregoing paragraph). He also mentions some experiments with solutions of chlorophyll, quinine sulphate, and fluorescein, which gave negative results. This agrees with our own experience, so far, at least, as chlorophyll solutions are concerned.

Mameli and Pollacci ('Atti dell' Ist. Bot. dell' Univ. di Pavia,' Series II, vol. 13) have published a critical memoir in which, in the first place, they re-affirm the possibility of detecting formaldehyde in the living plant: this appears now to be fully confirmed by Schryver (*loc. cit.*). These authors also failed to observe any evolution of oxygen *in vitro* when they repeated the experiment already referred to, but it is possible that, as they stated that they were unable to prepare a specimen of chlorophyll free from formaldehyde, this substance may have interfered with the action of the catalase in contact with the film of chlorophyll, in which case no oxygen would be produced.

### *Transmission of Amakebe by means of Rhipicephalus appendiculatus, the Brown Tick.*

By Dr. A. THEILER, C.M.G., Pretoria.

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That the disease in calves of Uganda called Amakebe is identical with East Coast fever had to be concluded after the presence of the so-called blue bodies of Koch, or plasma bodies, had been demonstrated in the internal organs; these bodies represent certain stages, agametes, agamonts, and gamonts, in the life cycle of *Theileria parva*. Accordingly, it had to be expected that Amakebe could be transmitted by means of such ticks, which act as hosts for this parasite. The most common tick of Uganda is the Brown Tick *Rhipicephalus appendiculatus*, which has been proved in South Africa to be the principal transmitter of East Coast fever.

When in Uganda in 1909 an arrangement was made between Mr. Hutchins, the Government Veterinary Surgeon of Uganda, and myself, to place adult brown ticks, collected as nymphæ from calves suffering from Amakebe, on susceptible calves in my laboratory in Onderstepoort, Pretoria, Transvaal; these ticks were to be collected by Mr. Hutchins as opportunity occurred.

On several occasions Mr. Hutchins forwarded me brown ticks, which he had placed in a glass tube; in every instance they arrived alive and in good condition, having moulted in transit from the nymphal into the adult stage. The first two lots of ticks failed to transmit the disease, the nymphæ probably having been collected off calves which had recovered from the disease, when the blood no longer contained the pathogenic parasite. Experiments with the last lot were successful, as will be shown hereunder.

EXPERIMENT TO NOTE WHETHER BROWN TICKS COLLECTED AS NYMPHÆ IN  
UGANDA FROM A CALF SUFFERING FROM AMAKEBE WILL TRANSMIT THE  
DISEASE TO SUSCEPTIBLE CALVES IN THE TRANSVAAL.

(1) *Bull calf* 1118, born and reared in Onderstepoort, was infested on January 23, 1911, with 10 adult brown ticks, forwarded by Mr. Hutchins from Uganda and received here on January 4, 1911. All 10 ticks were found attached to the calf the following day.

The calf showed almost immediately a rise of temperature, developing into a definite curve, during which the so-called marginal points (*Anaplasma marginale*) were noted to be present in great numbers; this curve was typical of the disease anaplasmosis, and the blood lesions found were those of an oligocythæmia (anisocytosis, poikilocytosis, polychromasia and basophilia) which followed as a sequel. The temperature gradually dropped, and the calf was found dead on the 22nd day after tick infestation. An examination of the lymphatic glands was made on the 17th day, and a negative result was registered.

*Post-mortem Examination on Calf* 1118.—The condition was fair. Rigor mortis was present. Tympanitis was noted. The lungs were partially collapsed and showed some atelectatic areas. On section a slight œdema became noticeable; in the trachea was some foam. The bronchial lymphatic glands were swollen, the mediastinal glands were normal.

The pericardium contained some clear liquid. The blood in the ventricles was well coagulated. Both endocardia were normal. The liver was enlarged and had a mottled appearance due to small pale areas; the parenchyma was soft. The periportal lymphatic glands were enlarged. The bile was yellow and viscid. The spleen was enlarged, measured 30 cm. by 10 cm., the pulp was softened, jam-like; the trabeculæ were indistinct. All four stomachs were normal.

The mucosa of the jejunum was slightly thickened and œdematous, that of the cæcum and colon was slate-coloured and contained a small number of disseminated parasitic nodules.

The kidneys were pale, the capsule was easily detachable and the urine was clear. The exterior lymphatic glands were swollen.

The microscopical examination of the blood proved the absence of any parasites. In the lymphatic glands the so-called plasma bodies of Koch were found and described as rather small, viz., agametes and young agamonts (according to Gonder\*); the same observation was made in preparations of the spleen.

*Diagnosis.*—East Coast fever.

(2) *Calf* 1143.—On February 14, 1911, this calf was infested with 10 adult brown ticks of the same lot obtained from Uganda. On February 15 seven of these ticks were found attached. After an incubation time of 13 days a typical fever curve ensued, which, however, never reached high records. The animal died on the 24th day.

On the 15th day after the tick infestation both blood and glands were examined and the result was negative. The examination on the 17th day revealed rare agamonts in the prescapular glands, but no parasites in the blood; on the 20th day both agamonts and gamonts were found in the lymphatic glands in a fair number, and *Theileria parva* was frequently met with in the red corpuscles.

*Post-mortem Examination of Calf* 1143.—Rigor mortis was present. The condition was rather poor. All external lymphatic glands were very much swollen. The lungs had not collapsed; there were some patches of red hepatisation in right anterior lobe and a small area in the left lobe. The lesions of hyperæmia and cedema were pronounced. There was a fibrinous coagulum in the trachea.

The bronchial and mediastinal lymphatic glands were enlarged and cedematous. The heart contained coagulated blood. Both the endocardium and the myocardium were normal. The liver was enlarged, the margins were rounded, the colour was reddish brown, the parenchyma was rather soft. The bile was green, thick, and viscid.

The spleen measured 30 cm. by 9 cm.; the pulp was soft and jam-like, and the trabeculæ were indistinct. The mucosa of the fourth stomach was slate-coloured; there were a few small hæmorrhagic ulcers. The mucosa of the jejunum showed longitudinal slate-coloured streaks. The mucosa of the ileum was slightly thickened, and dotted with punctiform hæmorrhages. The mucosa of the cæcum was thickened, the blood-vessels were injected, and there were patches of hyperæmia. The mucosa of the colon was slightly swollen and slate-coloured. The mesenteric glands were much enlarged and

\* 'Annual Report of the Government Veterinary Bacteriologist, Transvaal, S.A.,' 1909—10.

rather soft. The kidneys were rather pale; the boundary zone of the right kidney was slightly hyperæmic; the capsule was easily detachable. The bladder contained clear, yellow urine.

*Microscopical Examination*.—Koch's granules were found frequently in the lymphatic glands and spleen.

*Diagnosis*.—East Coast fever.

The infestation of two calves with adult brown ticks collected as nymphæ in Uganda from a calf suffering from acute Amakebe, was succeeded in both instances by a fatal disease, which could be diagnosed as East Coast fever from the appearance of the so-called Koch's blue bodies or plasma granules, which represent, according to Gonder, the agametes, agamonts, and gamonts in the life cycle of *Theileria parva*. The *post-mortem* examination corresponds with Amakebe of Uganda, and with what is known as East Coast fever. The fact that the blood of the first calf did not show blood parasites is nothing unusual in Amakebe. The agamonts were there, no gamonts had yet developed, accordingly no gametes of *Theileria parva* could be found. This calf apparently died at the beginning of the disease, the animal being weakened by the preceding *anaplasma* inoculation. The second calf represented in every respect a typical case of East Coast fever.

#### CONCLUSION.

Amakebe of Uganda is identical with East Coast fever of South Africa, and is transmitted by the tick *Rhipicephalus appendiculatus*. This conclusion corroborates that obtained by the Royal Society Sleeping Sickness Commission of 1909.

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